Case Study

Putting Biodiesel to a Steep Test Out in the Cold at Cranmore Mountain Resort

Introduction

In 2003, Cranmore Mountain Resort became the first ski area in the East to use biodiesel in its snow-grooming fleet, when it entered into an agreement with the Granite State Clean Cities Coalition (GSCCC) - a private-public partnership with ties to the federally-funded Clean Cities Program - and the NH Department of Environmental Services to participate in a pilot project demonstrating the efficacy of this plant-based fuel under extreme winter operating conditions.

Biodiesel, one of the fastest-growing alternative energy sources, is made from the oils of crops like soybeans or rapeseed (it can even be processed from used fryer oil), and can be burned in compression-ignition engines that use diesel fuel. A renewable resource, biodiesel can be produced in the U.S. and is less polluting than petroleum-based diesel.

Cranmore Mountain's switch to biodiesel provided an important demonstration project, in part because accounts of poor cold-weather performance from early adopters who had problems with biodiesel gelling and clogging fuel filters have deterred others considering making a switch. Pure biodiesel gels at a slightly higher temperature than #1 or #2 diesel and improper blending techniques by some early users led to problems. However, as the fuel has become mainstream, biodiesel providers have come to fully understand blending requirements and can readily provide biodiesel blends whose performance equals or exceeds conventional winterized diesel fuel. B20, a fuel blend of 20% biodiesel and 80% conventional diesel, performs on par with petroleum-based diesel while allowing users significant air quality benefits, including reductions in particulate pollution and a 15% reduction in carbon dioxide emissions.[1] B20 also has a cost differential less marked than that of B100 (pure biodiesel), making the price tag more palatable for potential high-volume users - such as Cranmore Mountain Resort.

CASE STUDY SNAPSHOT

Project: Cranmore switched its snow-grooming fleet (four snowcat Bombardiers) from regular diesel to a blend of 20% biodiesel, demonstrating B20's ability to operate heavy machinery in cold weather as effectively as regular diesel.

Funding: Grants from Granite State Clean Cities Coalition subsidized the switch during the project's first two years (2003-2005), covering the incremental fuel cost and providing some funds for the addition of an outdoor, above-ground fuel storage tank; The two grants totaled around $30,000. Cranmore is now fully funding the incremental fuel cost, 10¢ per gallon as of Feb. 2006.

Results: No loss of operability in snow-grooming fleet, healthier work environment, reduced air toxins, and favorable attention by ski industry and mainstream press.

Carbon dioxide reductions: More than 100 tons.

[1] www.eere.energy.gov/afdc/altfuel/bio_benefits.html

The Project

In 2001 the Granite State Clean Cities Coalition (GSCCC) – a collaborative of more than 65 public and private interests from all regions in New Hampshire supporting the use of alternative fuels to help reduce dependence on foreign oil and improve air quality – issued a request for project proposals that would demonstrate the feasibility of using biodiesel blends in New Hampshire in winter conditions.[2] Selected projects would be funded in collaboration between the GSCCC, the NH DES, and the NH Office of Energy and Planning.

Cranmore's proposal was to operate their terrain grooming fleet on B20 for one year, tracking fuel use, operational issues and other performance measures. Since the trail grooming machines are used daily throughout the ski season, often in the cold of night and sometimes in severe weather, this would provide a thorough "test case" of the fuel's cold-weather capabilities. It could also demonstrate that B20 – which has a slightly less energy per gallon then diesel[3] – could stand up to the tough job of powering equipment, pushing snow, up steep grades without a significant loss of fuel economy.

Cranmore's proposal was selected for funding and GSCCC agreed to pay the incremental cost of the biodiesel and also to help with expenses for rental and siting of a 4000 gallon above-ground storage tank for the B20. This aspect of the project addressed another concern with biodiesel, namely storage of a biodiesel blend in above-ground tanks. The "conventional wisdom" at the time was that biodiesel blends needed to be stored either indoors or in underground tanks to prevent the product from gelling. This project helped to demonstrate that if a consumer sets the appropriate specifications for their fuel it can be handled in the exact same manner as petroleum diesel. At the outset of the project the incremental cost was about $.40 per gallon plus a delivery fee of $0.44 per gallon; the grant had a budget cap of $14,000.

Cranmore began using the B20 in its snow-grooming equipment mid-way through the 2003-2004 ski season. Its grooming fleet consists of four Bombardier snowcats, three powered by 6-cylinder, 270 horsepower Cummings engines and one with an 8.81 liter, 350 horsepower Caterpillar engine with a turbocharger and air-to-air cooler. The resort also switched to B20 in the two John Deere auxiliary diesel engines used to power its ski lifts in the event of an electricity outage, and in sundry other diesel-powered pieces of equipment and vehicles, including their loader/backhoe. Making the switch involved no mechanical changes whatsoever (i.e. no retrofits, since diesel engines can run equally well on B20 or petroleum-based diesel), but did present a logistical hurdle or two.

Perhaps the biggest challenge had to do with supply. In early 2004 there were no established commercial biodiesel blenders in New Hampshire so Cranmore's Director of Operations Jim Mersereau turned to Chelsea, Massachusetts-based World Energy. World Energy is the nation's largest biodiesel distributor, which alleviated some of Jim's concerns about an inexpertly-mixed blend of biodiesel

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[2] http://www.granitestatecleancities.org/

[3] http://www.biodiesel.org/pdf_files/fuelfactsheets/CommonlyAsked.PDF

causing engine problems on a black diamond ski run at 2 a.m. in -25F temperatures with wind chills of -50F and below. But their location over 100 miles away meant that delivery was expensive and cumbersome. Cranmore rented a 4,000 gallon storage tank, and then had to find a location and pour a concrete pad to accommodate it. The cost associated with tank rental and placement came to about $7000 for the first year.

After one season of operating their equipment on B20, Cranmore went back to GSCCC to expand the grant to fund the incremental cost of the fuel for a full season, and to help purchase the storage tank they had been renting. In return, Cranmore agreed to continue to fund the project itself for at least two years subsequent to the grant's end. In the second season, Cranmore switched to a New Hampshire-based supplier, Rymes Oil, which had recently begun offering biodiesel. The switch cut down on delivery mileage, time and cost, thus allowing Cranmore to complete the season well under the $19,800 budget cap.

Beginning with the 2005-2006 ski season, Cranmore began fully funding its own biodiesel purchases, paying a premium of about 10¢ per gallon of fuel. Though contractually obligated to use the biodiesel only through the end of the '06-'07 ski season, Jim Mersereau says the resort has absolutely no interest in switching back to conventional diesel at that time. They see the value of biodiesel as more than equivalent to the cost differential - which continues to shrink as the price of oil climbs and the biodiesel market grows.

The Results

Since the start of this project, Cranmore has burned more than 60,000 gallons of B20 in its equipment in place of conventional diesel, reducing their use of petroleum by 12,000 gallons. The switch, identified early on by former Cranmore General Manager Ted Austin as "good PR and good business," and by current General Manager Ben Wilcox as "the right thing to do," has proven the reliability of biodiesel even under intense and demanding winter conditions. Says Cranmore Operations Director Mersereau, "We've had no trouble at all, absolutely none. Our groomers run with the same efficiency as before. Now they just run cleaner - producing less smoke and fumes."

In fact, this switch from diesel to biodiesel has had an appreciable impact on air quality, translating to a 10% reduction in lung-clogging particulates, a 20% reduction in sulfur dioxide emissions, and a reduction in carbon dioxide emissions of more than 100 tons.[4] As part of an industry that is almost entirely climate-dependent, this step toward addressing Cranmore's own contribution to the problem of global warming is significant. The choice to help conserve natural resources while supporting energy independence and more localized energy providers (because biodiesel is made from crops that can be grown in America, supporting local farmers and U.S. distributors like NH-based Rymes) is a point of pride with the resort's staff and management.

There have been operational benefits too. According to the U.S. Department of Energy's Clean Cities website, B20 is easier on engines than petroleum diesel because of its higher lubricity, which leads to cleaner-running engines and reduces the damage generally associated with "wear-and-tear."[5]

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[4] Assumes, throught the end of the '05-'06 ski season, 60,000+ gallons B20 replacing 60,000+ gallons of petroleum diesel. 60,000 gallons of diesel creates 666 (short) tons of carbon dioxide (based on 22.2 punds of CO2 p/g of diesel burned: http://www.epa.gov/otaq/climate/420f05001.htm#calculating). A 15% reduction (based on figures from the Alternative Fuels Data Center of the U.S. DOE's EERE program [http://www.eere.energy.gov/afdc/altfuel/bio_benefits.html]) in that figure, 666 tons, is equal to approximately 99.9 (short) tons.

[5] http://www.eere.energy.gov/cleancities/blends/biodiesel.html

Cranmore mechanic Bob Blake notes that the spent oil filters are noticeably cleaner when it comes time for oil changes, and that another effect of the switch to biodiesel has been fewer fuel filter failures.

While it's too early to tell what long-term cost difference using biodiesel has made when it comes to equipment maintenance, the men who work with the equipment day-to-day see biodiesel as clearly being better for the machines – and for the people working on them.

"When you run vehicles in and out of the garage, the fumes are less obnoxious," Mersereau adds, saying he believes there have been fewer headaches and health complaints among staff since Cranmore made the switch. These observations are supported by a large body of research on the public health benefits of biodiesel, which demonstrate a 20-40% reduction in harmful, disease-causing air pollution, when burning B20 compared to petroleum diesel.[6]

One area of concern in switching to biodiesel was a potential loss in fuel economy,[7] since B20 has 1%-2% less energy per gallon than does a gallon of petroleum diesel fuel.[8] Cranmore does not have detailed records available that would allow for analysis of fuel economy performance of the equipment before and after the implementation of this project. However, anecdotal evidence from both Mersereau and Blake suggest that any effect on fuel efficiency has been negligible; neither has noticed a difference in frequency of fill-ups for the resort's fleet.

Cranmore has attracted positive attention for switching to the cleaner-burning fuel, enjoying local and regional media coverage as well as attention from within the industry. In May, 2005, at the 29th Annual Governor's Conference on Tourism, the NH Travel Council and NH DES presented Cranmore Mountain Resort with a prestigious Sustainable Business Award, citing Cranmore's pioneering use of biodiesel, as well as subsequent investments the ski resort has made in energy efficient snow-making machines, as measures worth honoring.

Lessons Learned

The most significant lesson from this pilot project is, obviously, that a B20 blend of biodiesel can be used safely and effectively in northern climates and in winter conditions with heavy equipment. Cranmore's success with biodiesel showcases the fuel's operational as well as environmental benefits.

Economics can be an initial sticking point; however the current 10-12¢ cost differential in the purchase price of a gallon of biodiesel versus regular diesel is 70% less then what Cranmore faced when it began using the fuel in 2003, and biodiesel continues to become steadily more competitive. Supply is a big part of this equation; having a commercial supplier close at hand keeps the logistics and cost of fuel delivery and storage from being prohibitive. There are now six NH-based biodiesel distributors registered with the National Biodiesel Board, and several in the surrounding states.[9] Several production facilities are also slated to be coming on-line in New England over the next year, and we are starting to see the benefits of the Energy Policy Act of 2005 that established tax credits for biodiesel blenders kick in — all factors increasing supply and likely reducing prices. As diesel costs continue to climb,

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[6] http://www.nrel.gov/vehiclesandfuels/npbf/pdfs/tp36182.pdf, p.12

[7] http://www.cleanairfleets.org/altfuels.html

[8] http://www.nrel.gov/vehiclesandfuels/npbf/pdfs/tp36182.pdf, p.13

[9] http://www.nbb.org/buyingbiodiesel/distributors/showstate.asp?st=NH

biodiesel costs are expected to remain fairly constant; an equation which points to continued shrinking of the existing difference in cost.

Formal systems for cost-benefit analyses of the fuel switch – including tracking of fuel economy and maintenance cost – were not available for this project. As Cranmore is quite satisfied with the results of the switch and sees it as more than just an economic decision, this was not a deterrent in choosing to stick with the biodiesel. However, Mersereau says the resort is now planning to begin tracking fuel economy more closely.

The switch to biodiesel has also created some angst in the resort's accounting department. On-road diesel fuel is subject to both an $0.18 state tax and a $0.0244 federal fuel tax. Non-road fuel is normally exempt from this tax and is dyed red to identify it. Because there currently is no mechanism to properly dye the biodiesel the B20 is subject to the on-road tax even when intended for non-road use. It is possible to apply for a refund of those state taxes, along with a portion of the state "pollution" fee - but the paperwork is burdensome, particularly because of a new requirement by the state that these applications be made quarterly. Cranmore is likewise looking into opportunities to be refunded portions of the federal excise tax placed on the fuel, but again the bookkeeping aspect of this process appears formidable. Policy issues like these are stumbling blocks to wider business adoption of biodiesel as a fuel of choice.

In spite of some policy stumbling blocks, there are an increasing array of state and federal incentives and programs designed to increase the availability and competitiveness of biodiesel.[10] By taking advantage of the grant funds made available through this pilot project from the NH DES and Granite State Clean Cities Coalition, Cranmore Mountain resort has increased its operating efficiency and effectiveness, making itself more competitive within an industry that will depend upon similar acts of leadership and innovation to maintain the stable climate required if it is to continue to thrive.

Company Profile

Cranmore Mountain Resort is located north of Boston in the village of North Conway, New Hampshire – a major vacation destination. Cranmore is part of the Booth Creek family of resorts: Loon Mountain, Waterville Valley, Northstar-at-Tahoe, Sierra-at-Tahoe and the Summit-at-Snoqualmie. Cranmore offers 40 trails, 200-plus skiable acres, and a snow-tubing park. More at www.cranmore.com.

For more information on biodiesel, visit the National Biodiesel Board website at www.biodiesel.org

CASE STUDY RATING

This case study reduces CO2 emissions equivalent to the following:

Avoiding the consumption of more than 180 barrels of oil . (1 barrel icon = 10 barrels)

Or taking more than 13.8 vehicles off the road for one year.

(Assumptions: 1,093 lbs of CO2 per barrel of oil. Vehicles are average passenger cars (approximately 20 lbs CO2 per gallon of gasoline Ð 22.5 miles per gallon, averaging 16,000 miles per year)

[10] www.biodiesel.org/news/taxincentive/

About Granite State Clean Cities Coalition

The Granite State Clean Cities Coalition is a collaborative of over 65 public and private interests from all regions in New Hampshire. Coalition members support the goals of reducing dependence on foreign oil and improving air quality through the use of domestically produced, cleaner burning alternative fuels and other fuel reduction strategies.

Clean Cities is a program sponsored by the U.S. Department of Energy, which is designed to encourage the use of Alternative Fuel Vehicles (AFV's) and their supporting infrastructure throughout the nation. By encouraging AFV use, the Clean Cities program will help achieve energy security and environmental quality goals at both the national and local levels. Unlike traditional command-and-control programs, the Clean Cities program takes a unique, voluntary approach to AFV development, working with coalitions of local stakeholders to help develop the AFV industry and integrate this development into larger planning processes.

For more on GSCCC: www.granitestatecleancities.org/

About Clean Air - Cool Planet

Clean Air-Cool Planet creates partnerships with campuses, corporations, and communities throughout the Northeast to help them implement measures that will reduce greenhouse gas emissions.

We offer an inventory tool that enables our partners to accurately assess their emissions and plan reduction or elimination strategies. Partners typically employ a combination of energy efficiency measures and renewable energy sources.

We help citizens understand the impacts of global warming by documenting and publicizing the benefits of emissions reduction measures to promote more environmentally sound business and consumer choices.

Through our programs and partnerships, Clean Air-Cool Planet helps other organizations and opinion leaders effectively address the issue of global warming.

For more on Clean Air-Cool Planet visit www.cleanair-coolplanet.org.

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